FFAG07 Workshop Summary

J. Scott Berg
Brookhaven National Laboratory
NFMCC Friday Meeting
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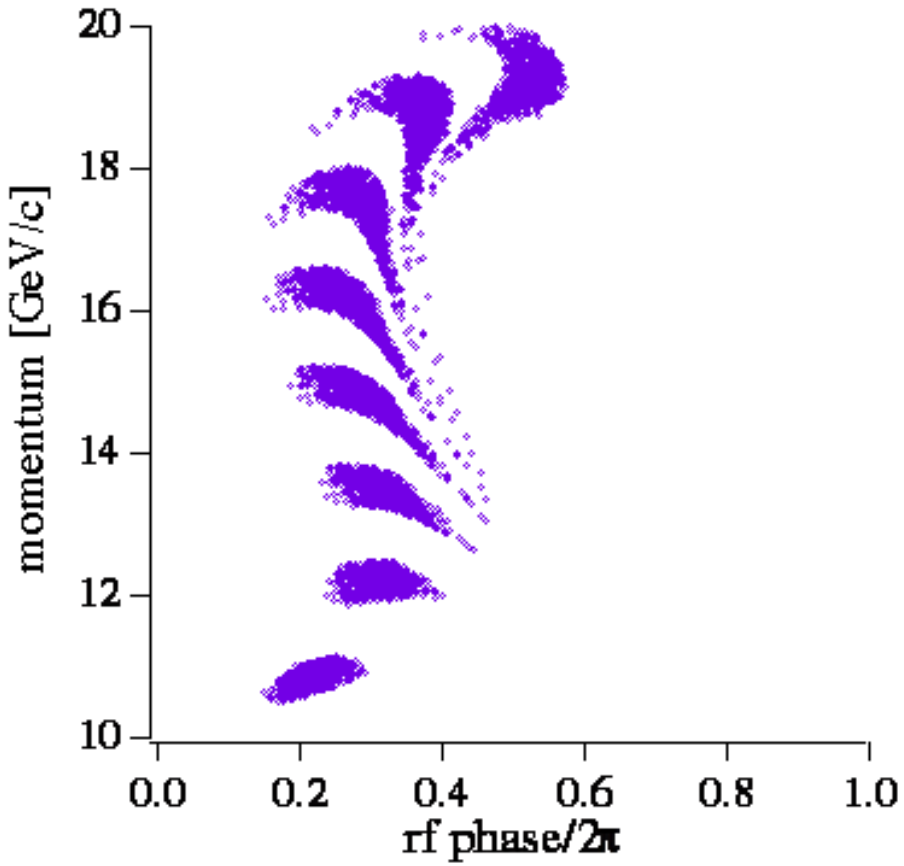
Outline

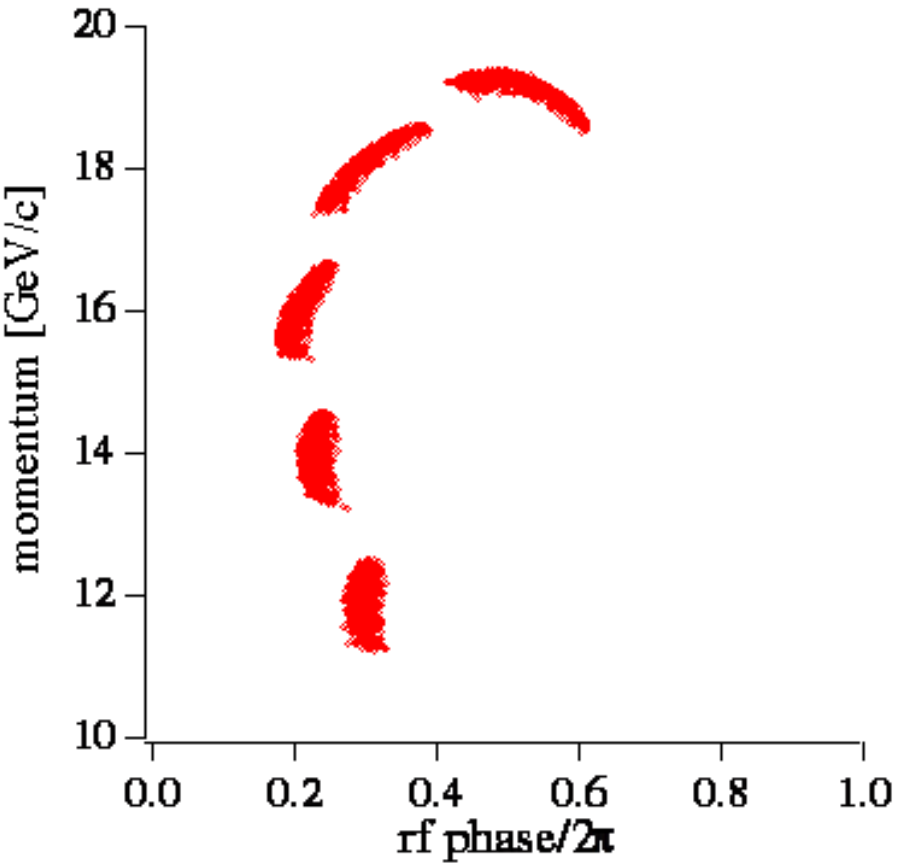
- Chromaticity correction in FFAGs
- EMMA
- Low-frequency EMMA cavity
- Muon acceleration in scaling FFAGs

Chromaticity Correction

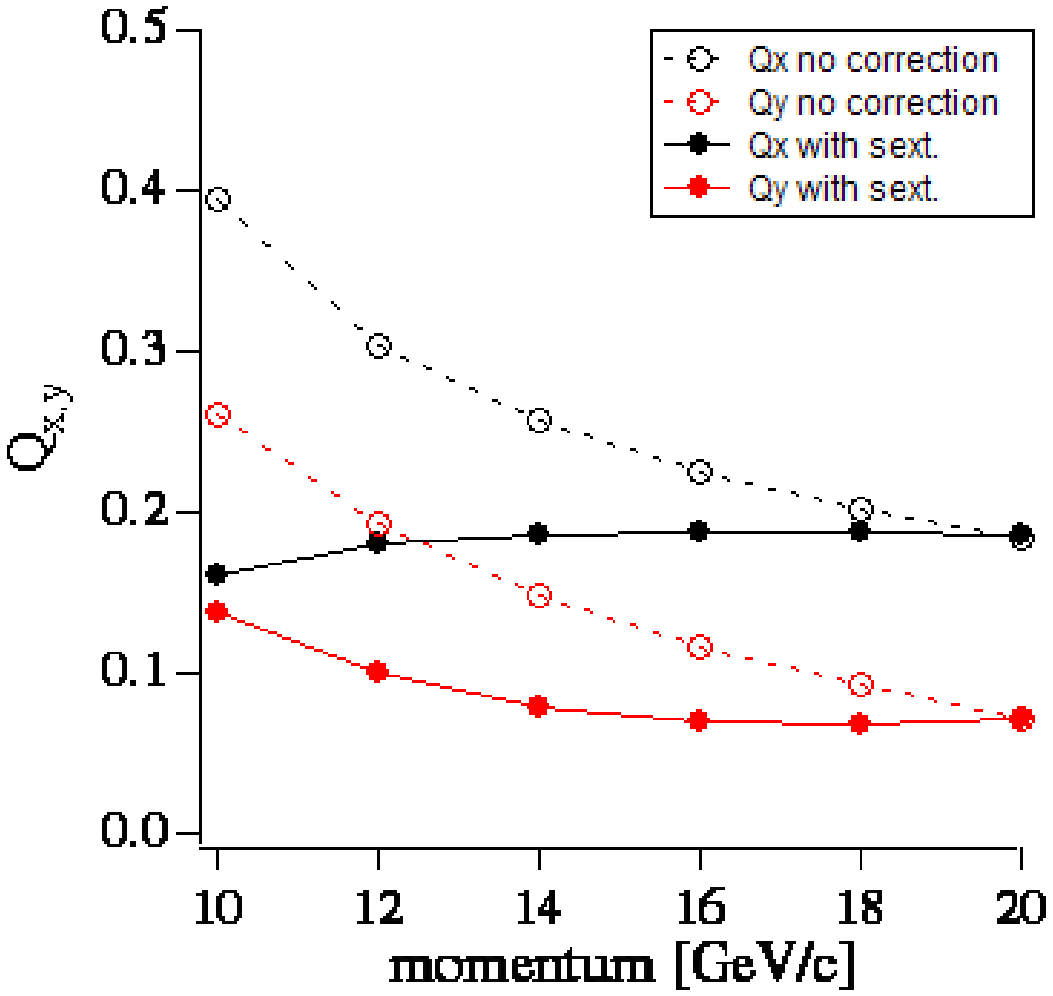
- Time of flight depends on transverse amplitde
- Longitudinal dynamics problems
- Chromaticity correction should help
  - Many multipoles to flatten
  - Only sextupole, not perfect
- Problem: dynamic aperture
  - Seems acceptable for small number of turns

Longitdinal Dynamics With and Without Chromaticity





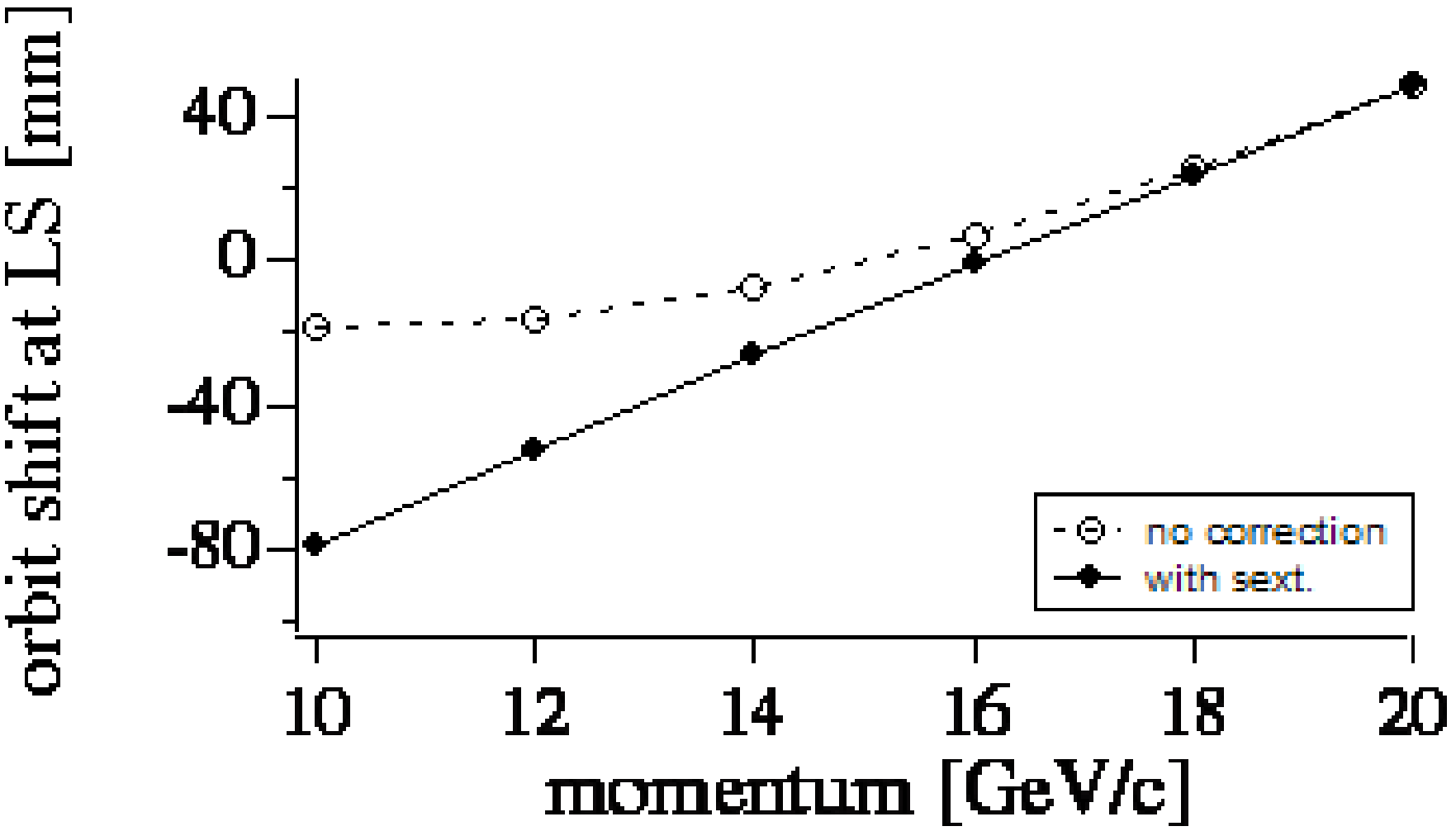
Tunes with Chromaticity Correction



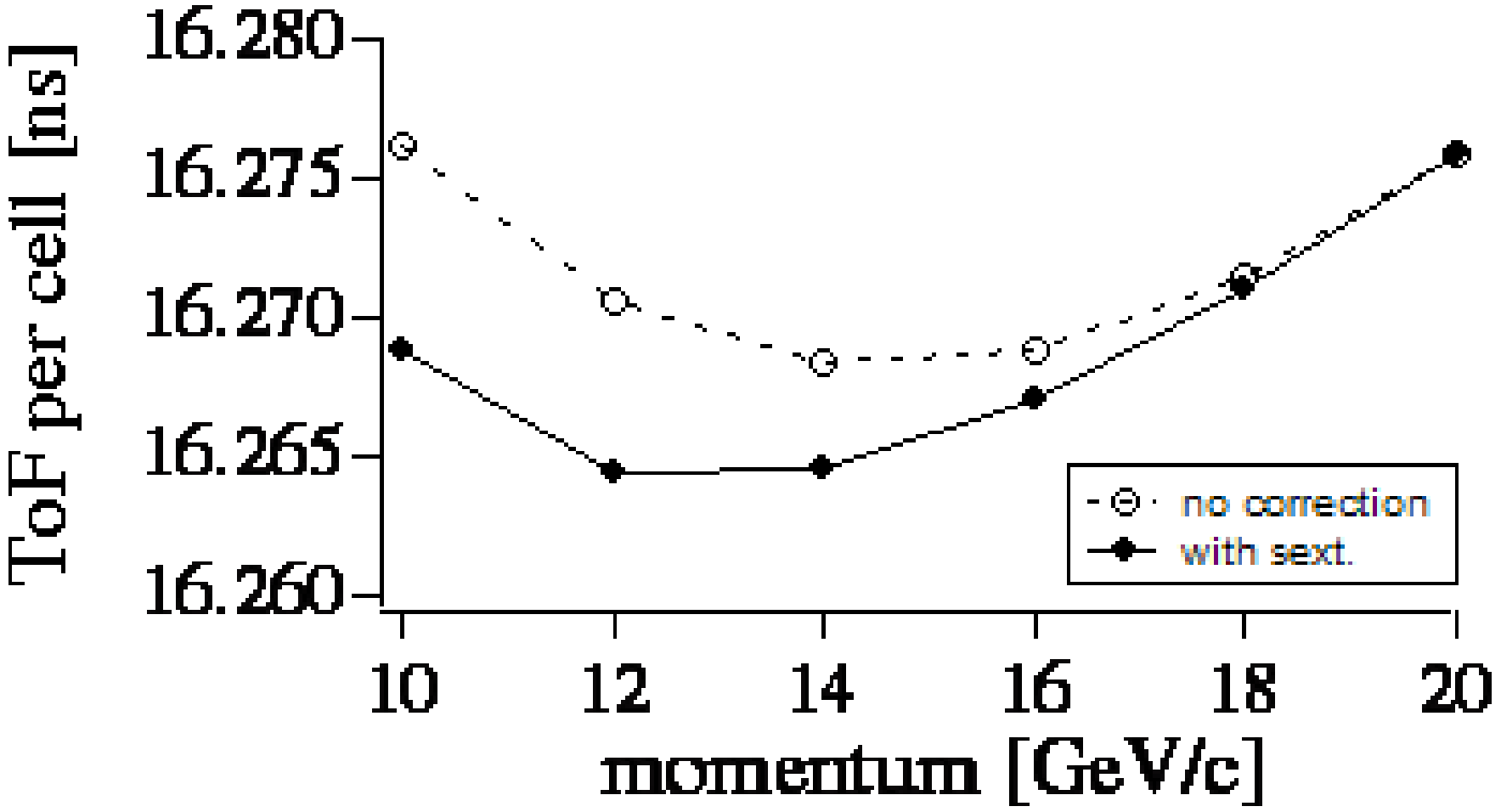
Chromaticity Correction

- Required aperture wider
- Time of flight not symmetrized
- Possible related to low tune used
  - Higher tune has dynamic aperture problems
- Emittance growth worse for more turns

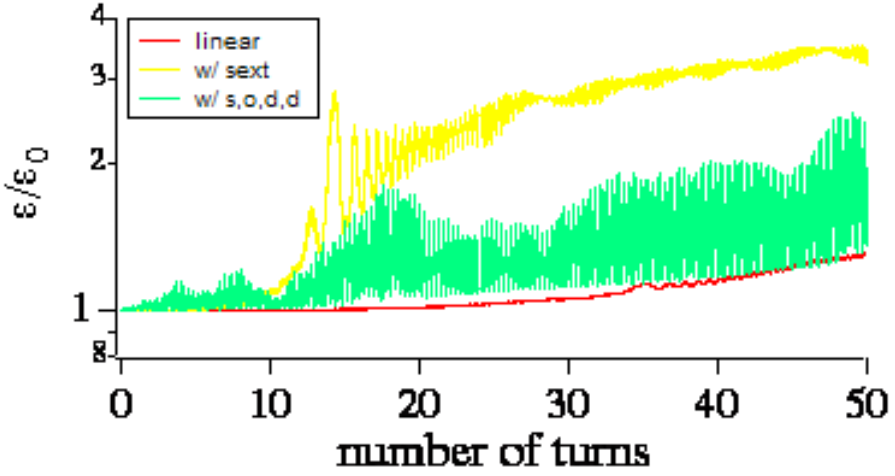
Chromaticity Correction
Horizontal Closed Orbit

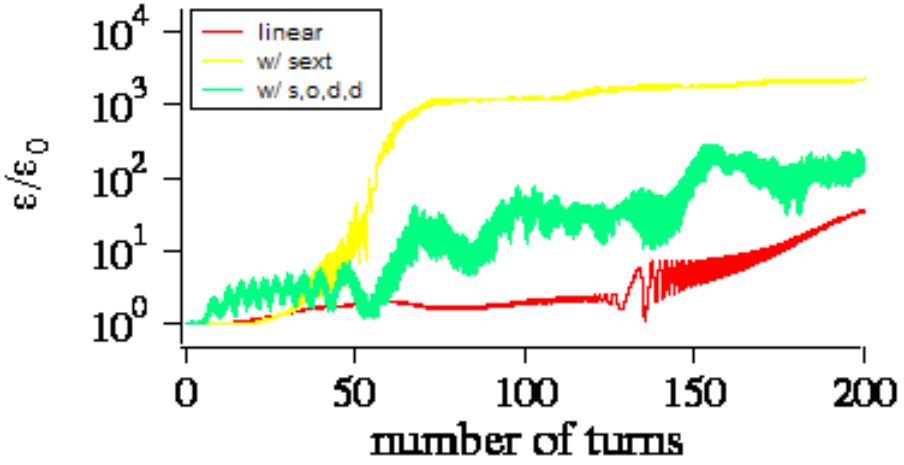


Chromaticity Correction
Time of Flight



Chromaticity Correction
More Turns

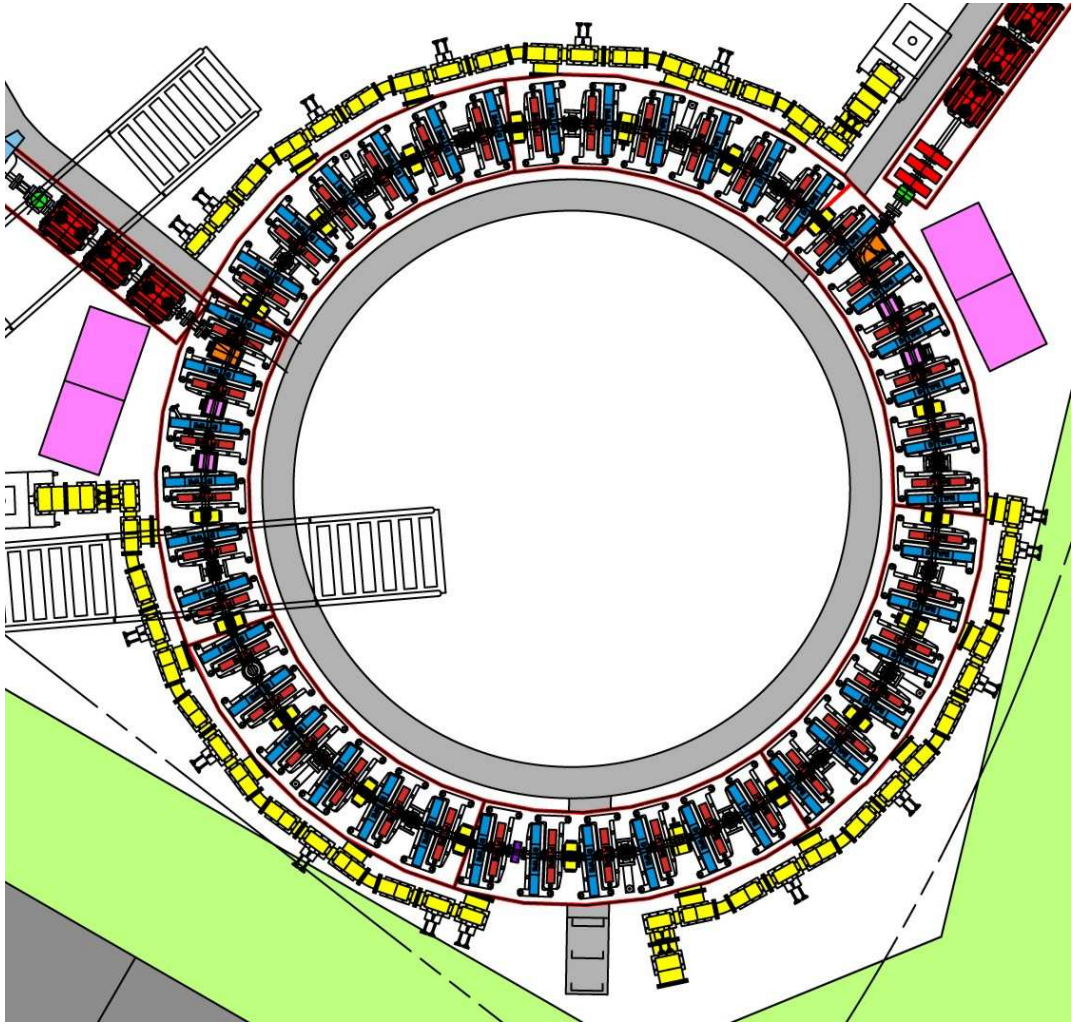




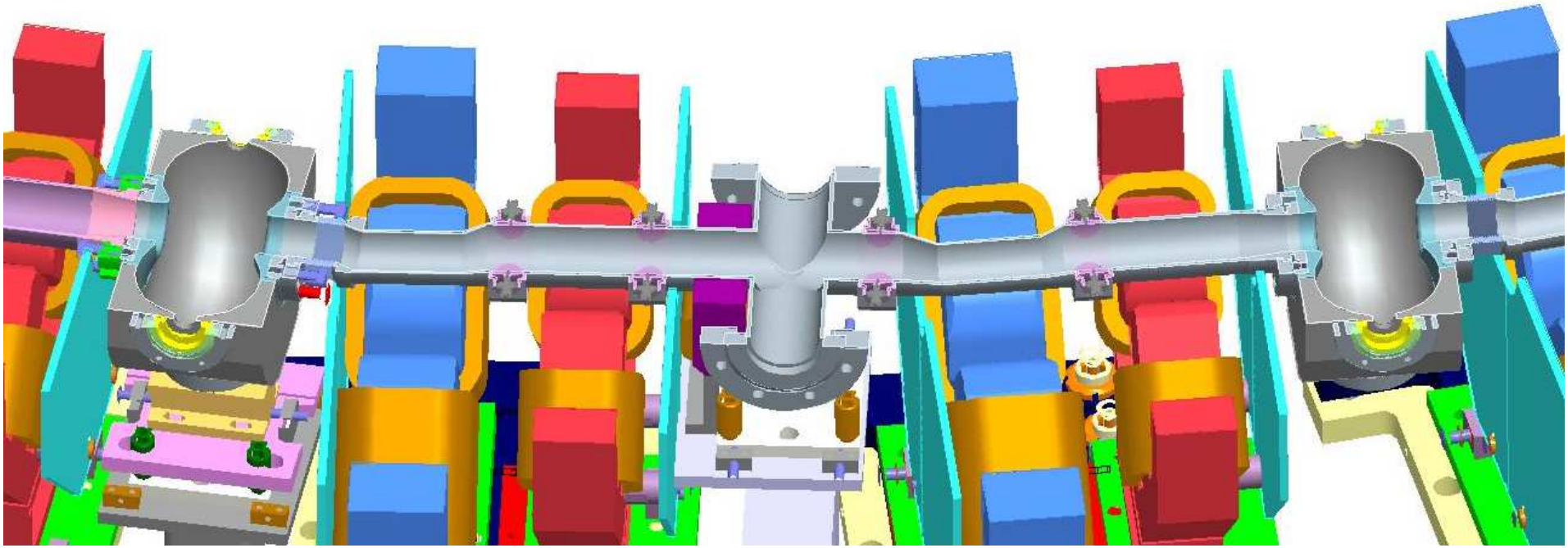
EMMA

- Electron model of linear non-scaling FFAG
- Type of machine we're proposing for late-stage neutrino factory acceleration
- Study longitudinal dynamics
- Study resonance-crossing effects

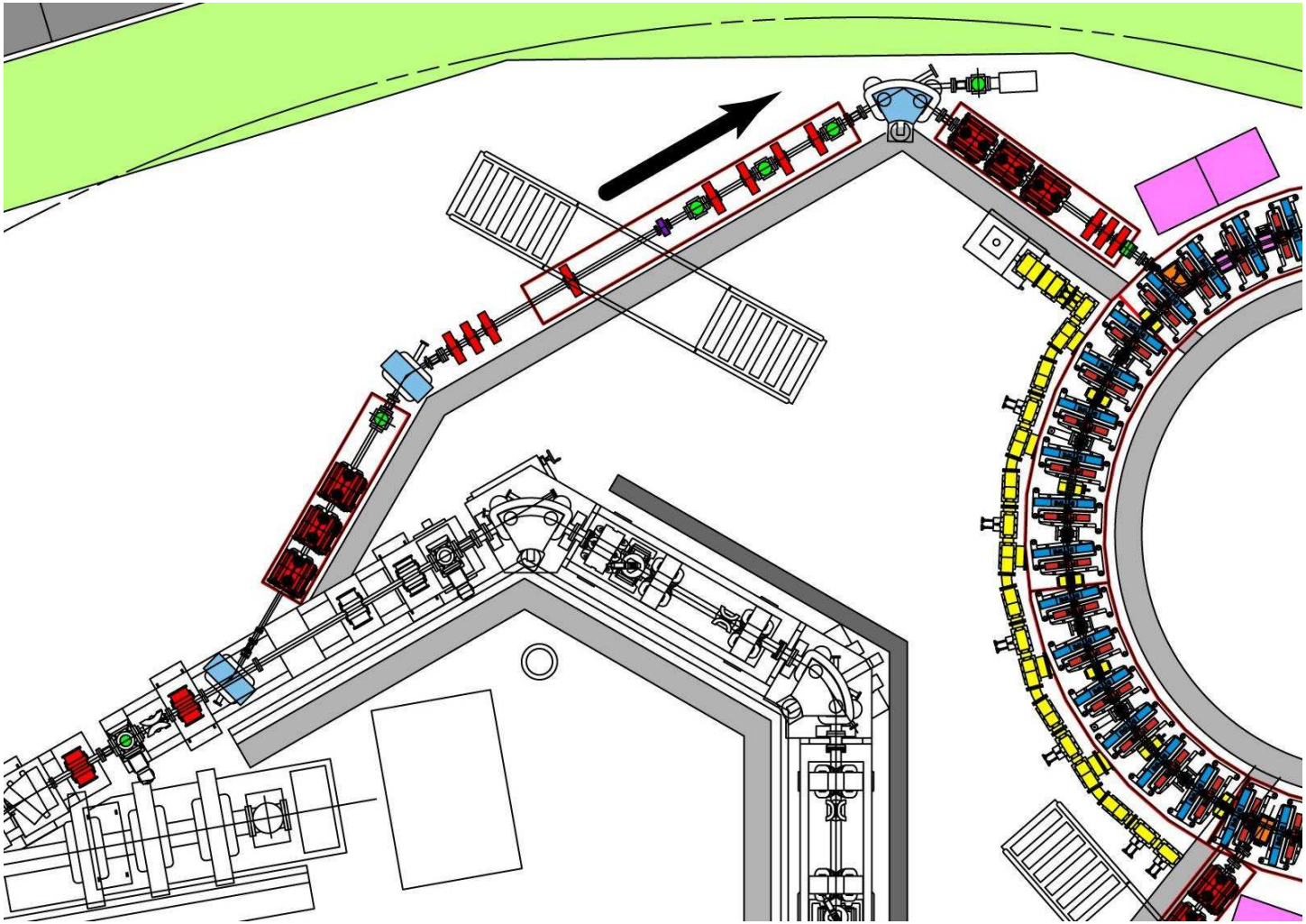
EMMA
Main Ring



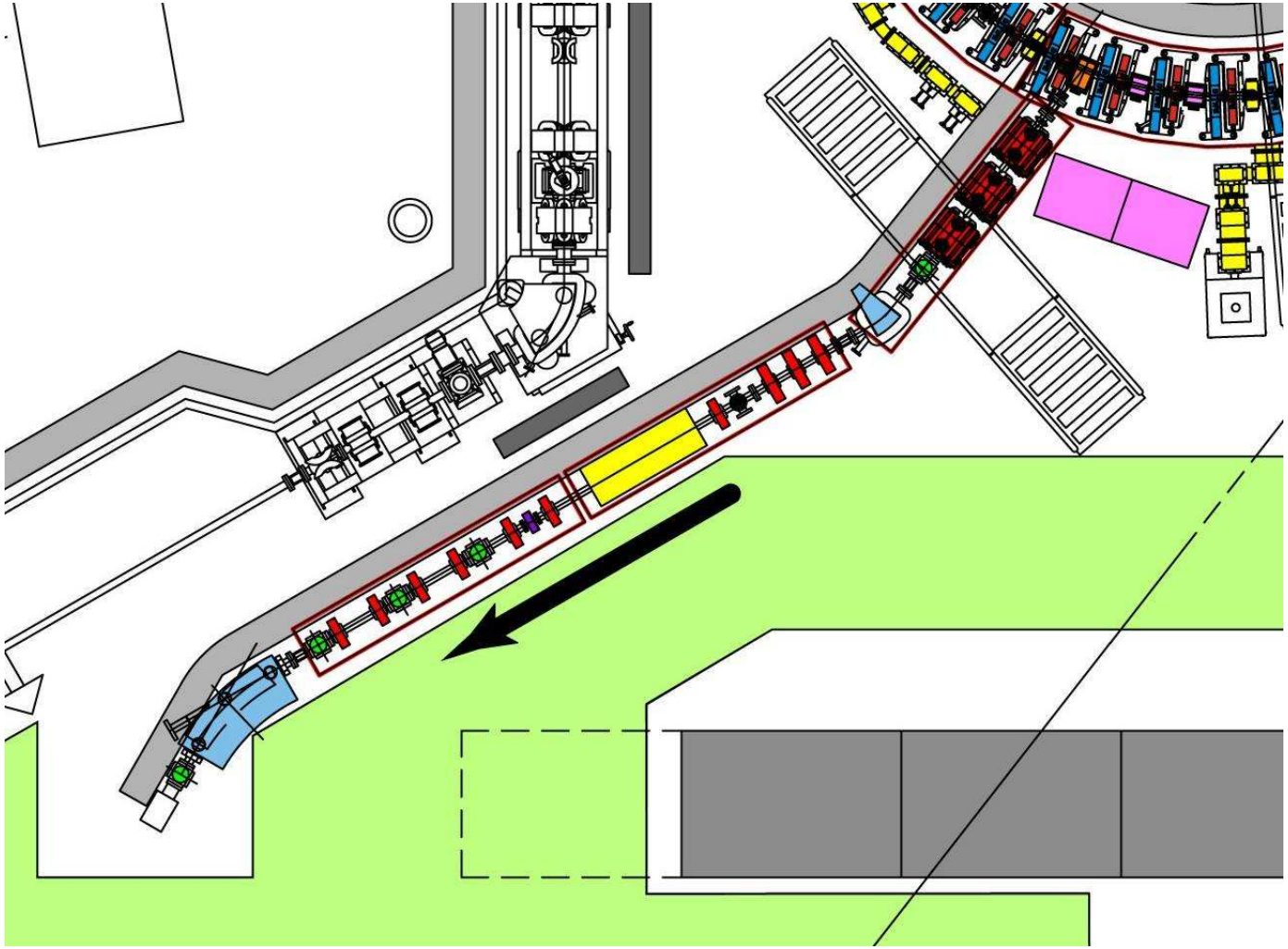
EMMA
Lattice Cell



EMMA
Injection Line



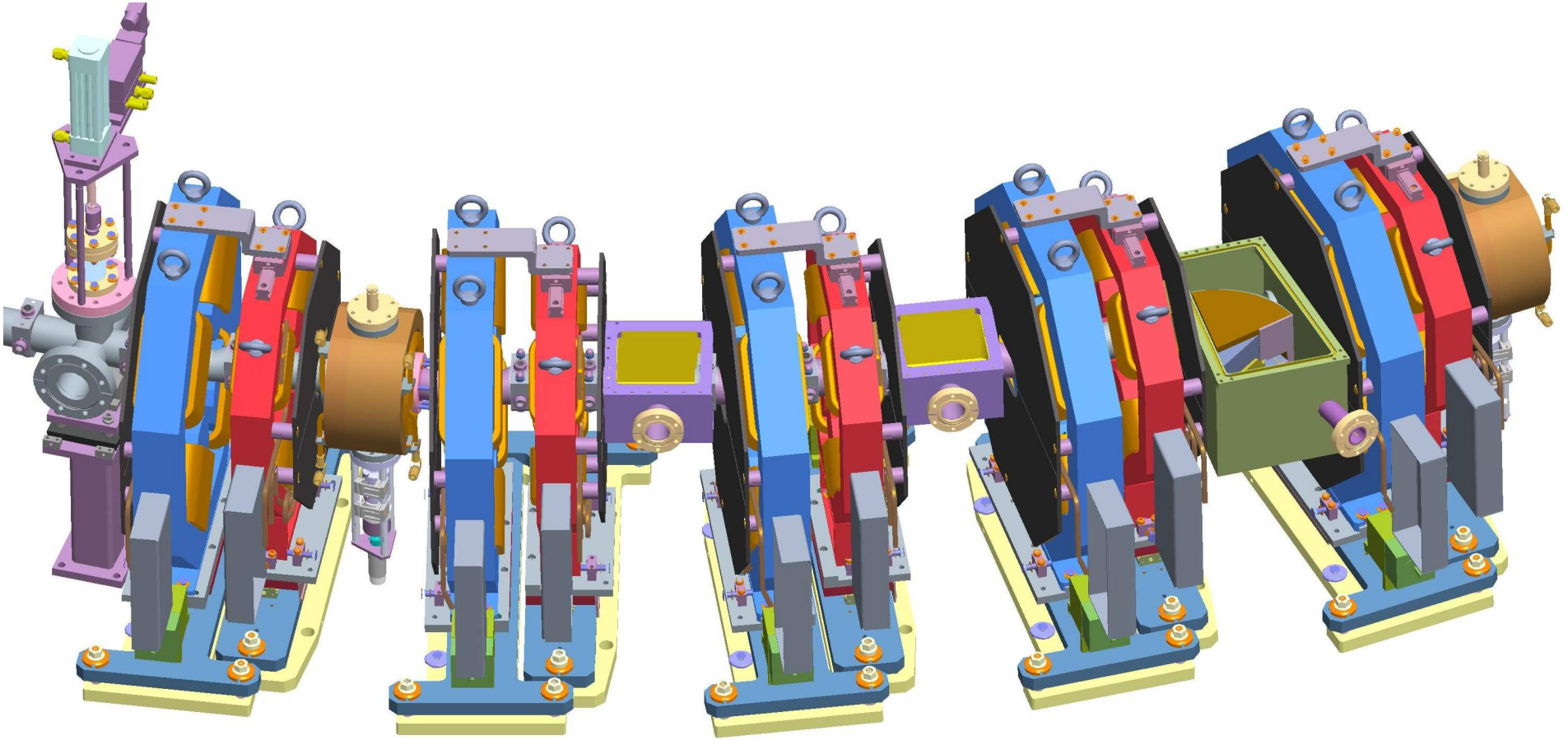
EMMA
Extraction Line



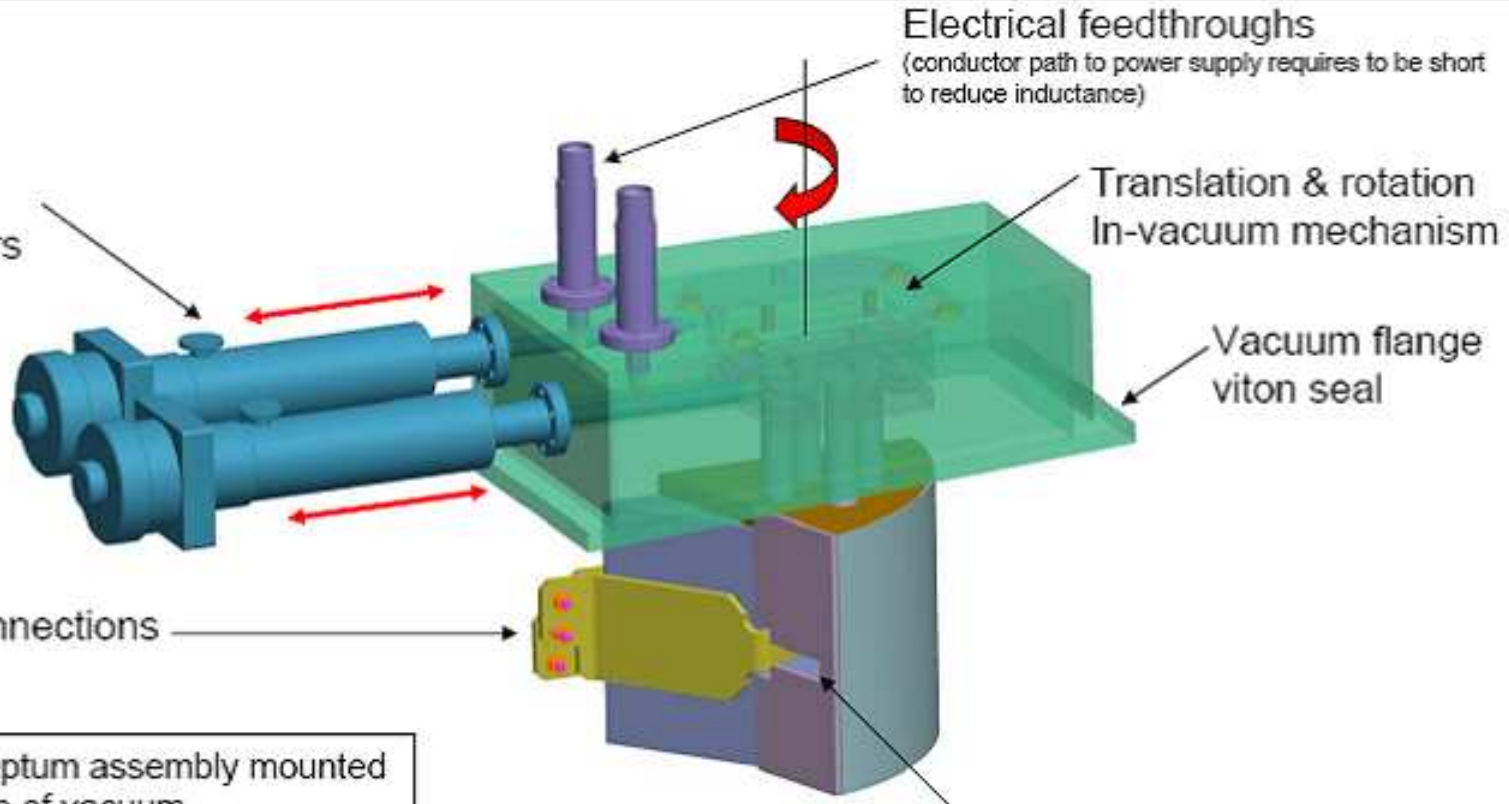
EMMA
Injection Challenges

- Orbit oscillations too large
  - Not enough magnet aperture
  - Some disagreement on this point
- Septum can be moved
  - Won’t help much on injection
- Re-order magnets to make injection easier
- Making sure kicker stops cleanly

EMMA
Injection System

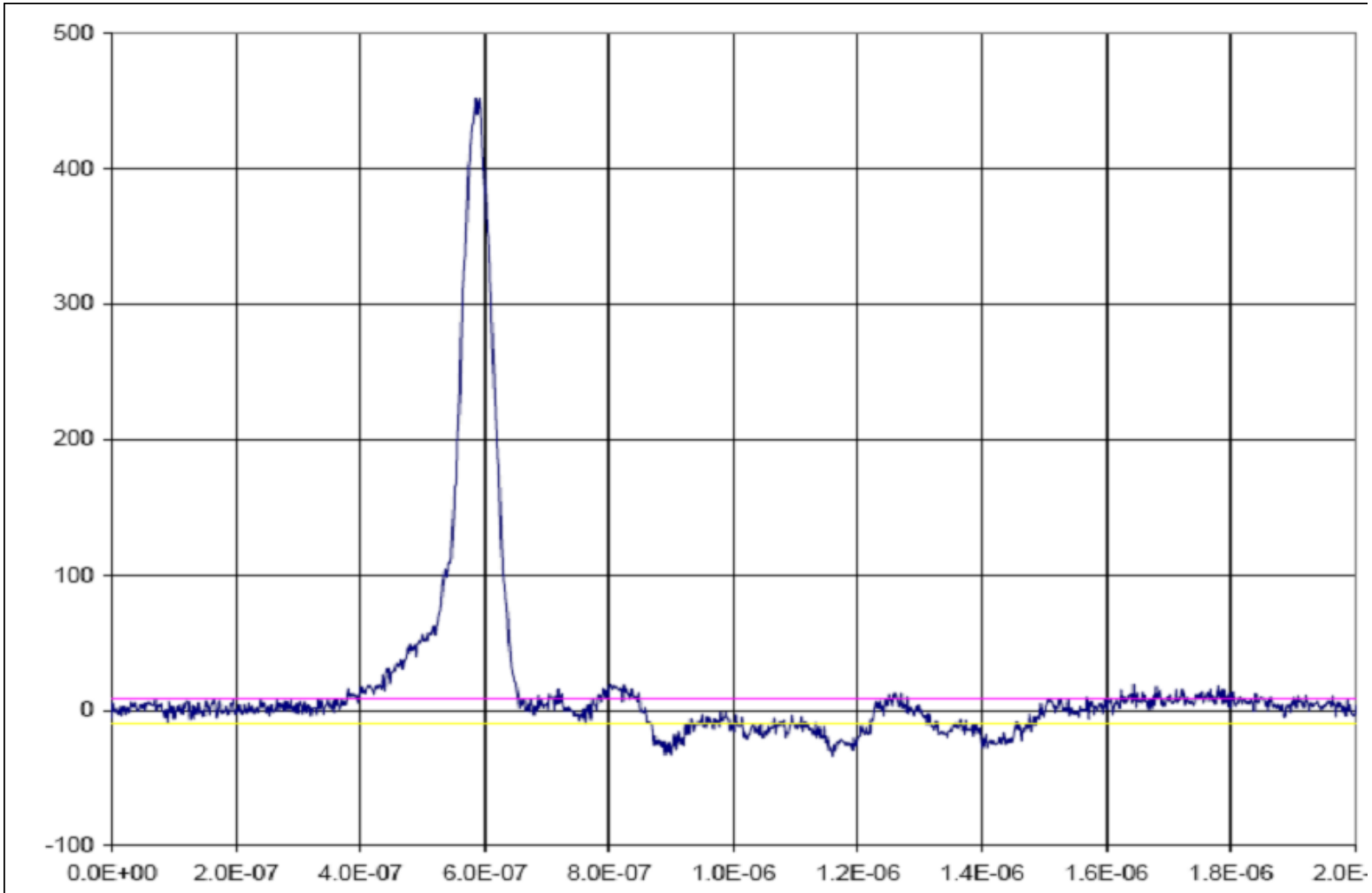


EMMA
Injection Septum



- Complete septum assembly mounted from top section of vacuum.
- 2 linear actuators provide translation and rotation of septum.

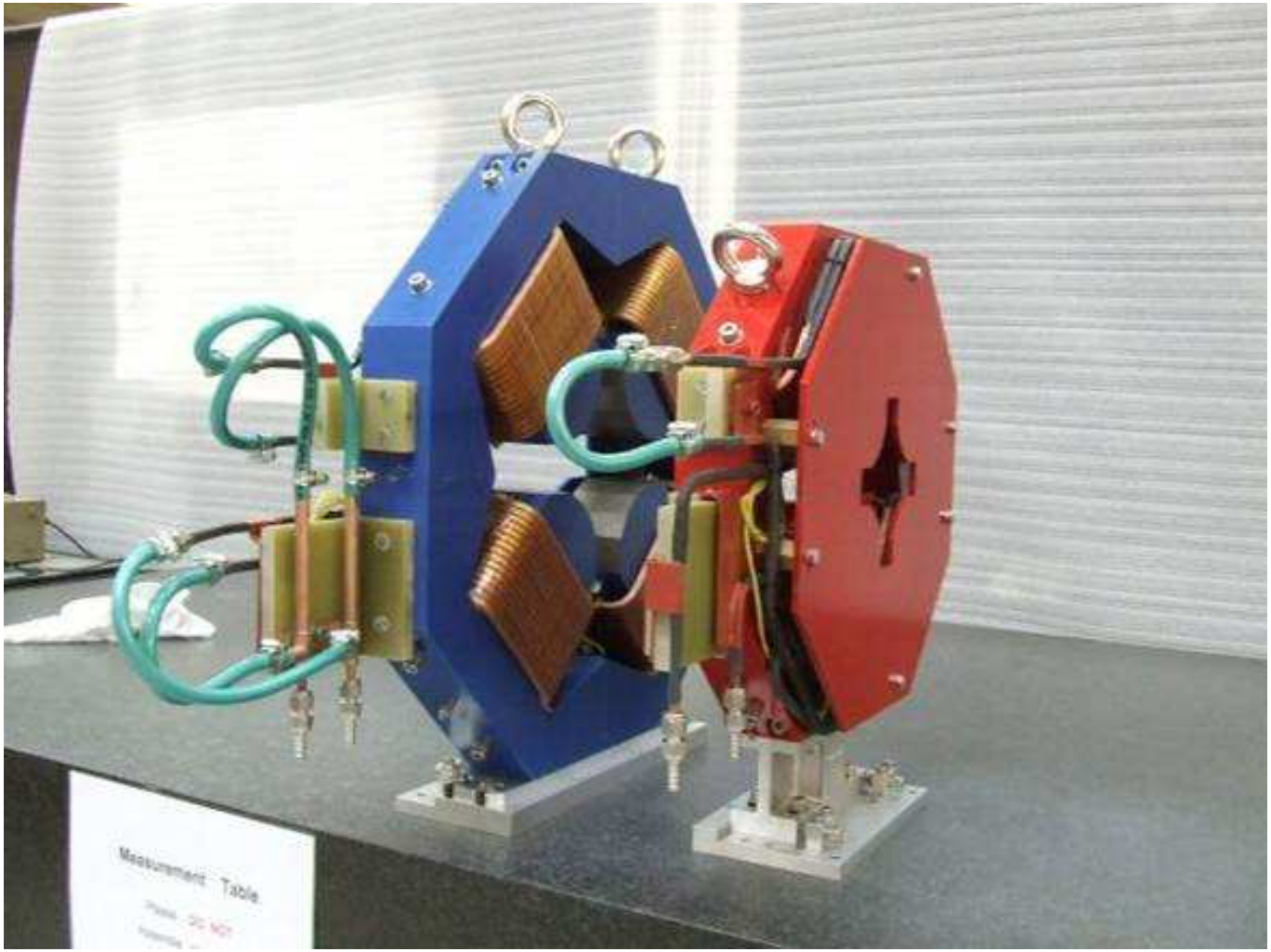
EMMA
Kicker Pulse



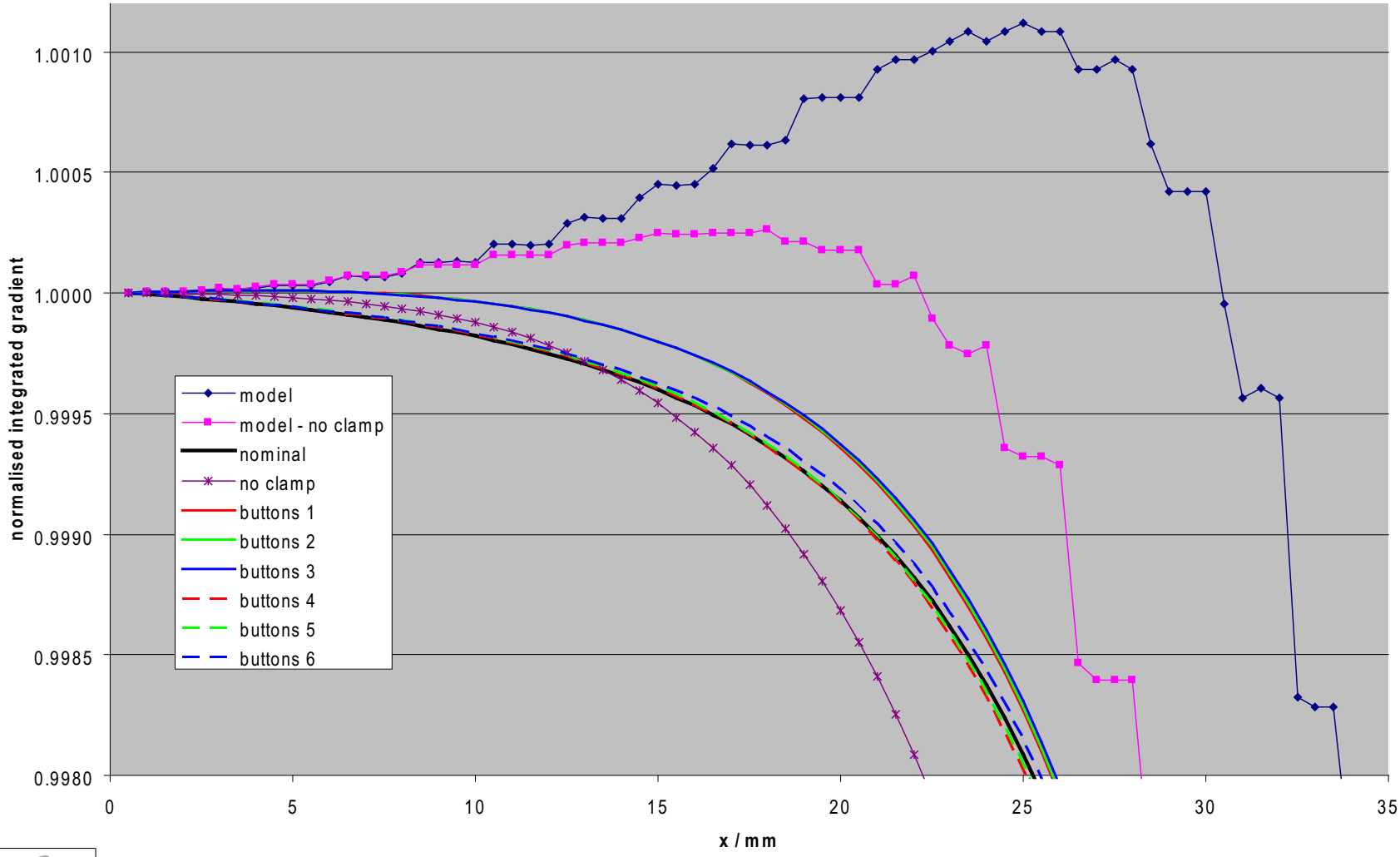
EMMA
Magnet Prototypes

- Have prototype magnets back
- Measuring them (rotating coil)
- Not quite what we would like, but acceptable
- Clamps have a substantial effect
- Added iron buttons to try modifications

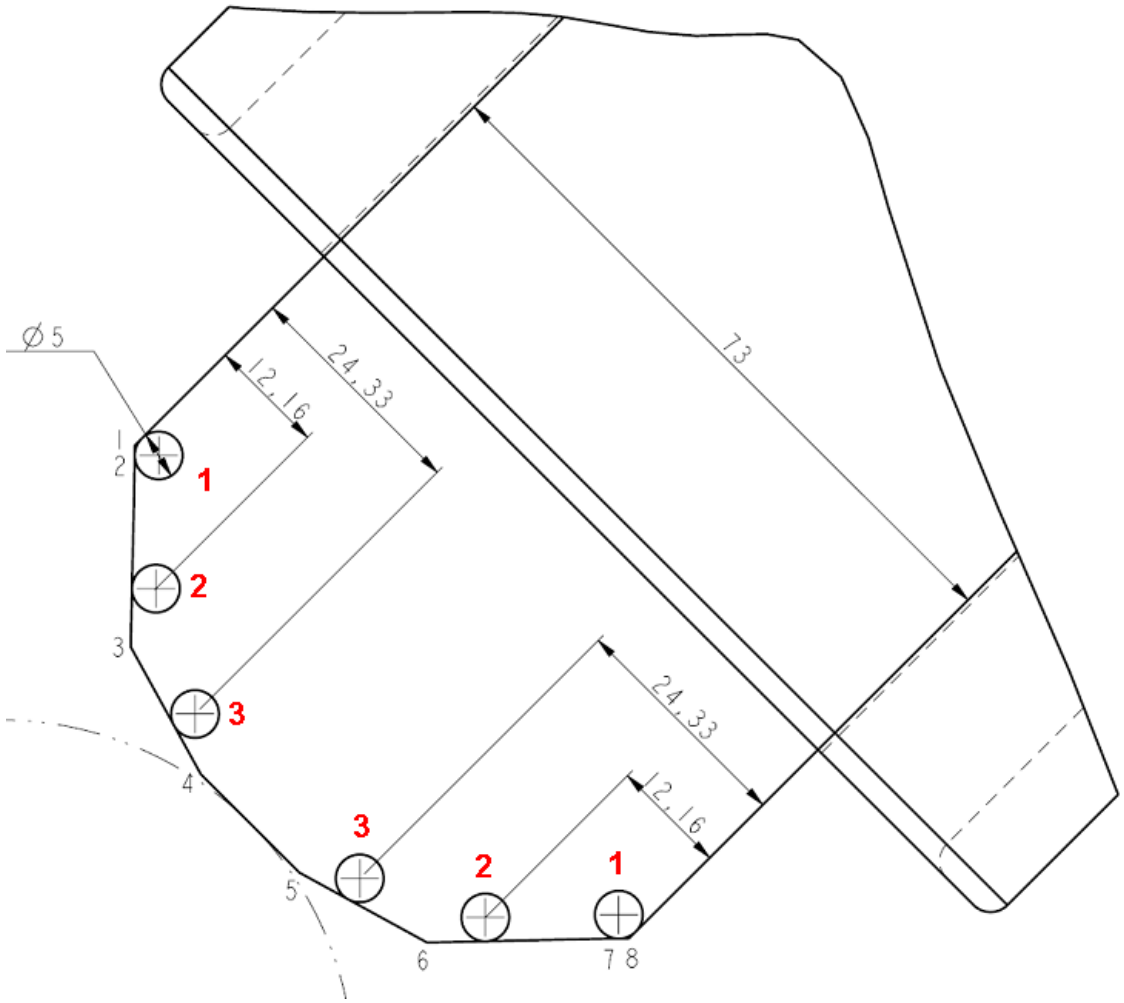
EMMA
Magnet Prototyupes



EMMA
Measured Fields



EMMA
Buttons



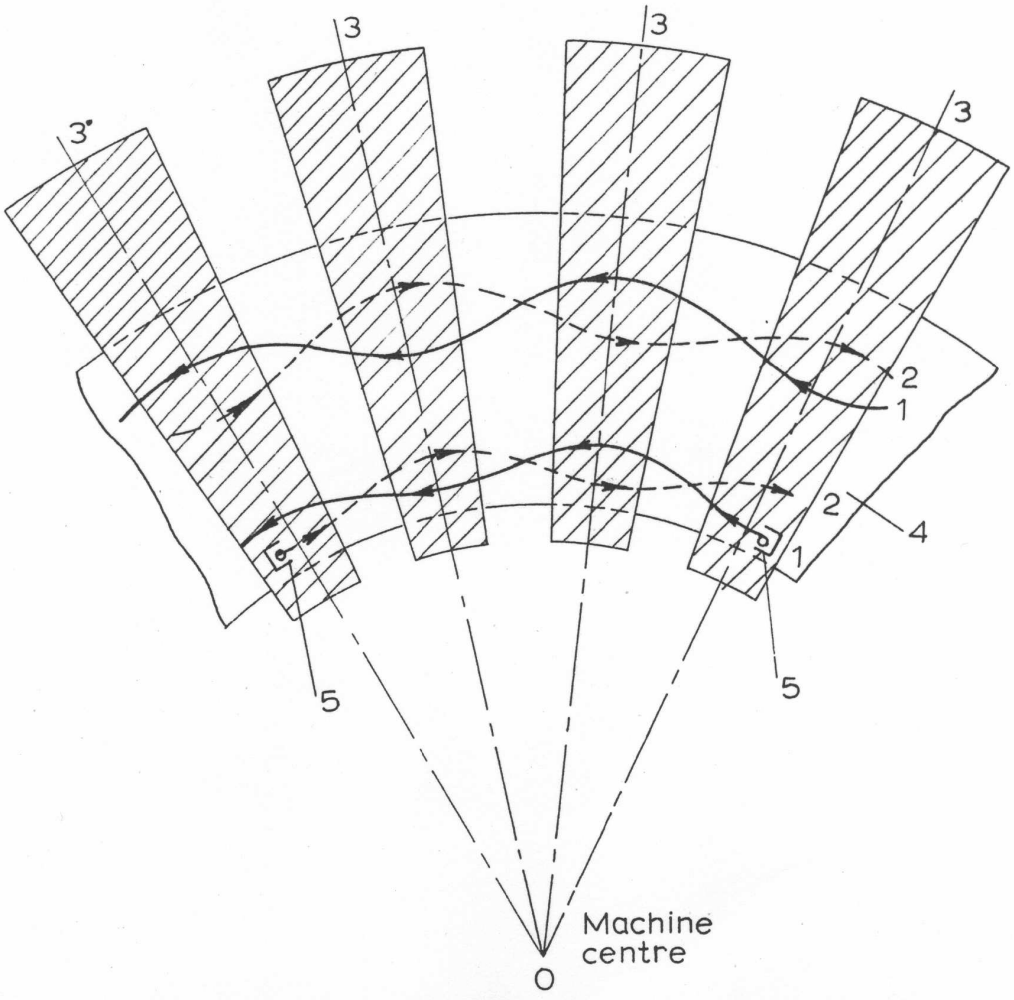
EMMA
Low-Frequency Cavity

- Would like to accelerate more slowly
- Need low-frequency RF to do this
  - Harmonic 1: 20 MHz
  - 100 kV for 100 turns, reduce from there
- Use magnetic alloy cavities
  - 6 cavities in 2 stations
- Cost just below $1M (?)

Scaling FFAGs
Harmonic Number Jump

- Scaling FFAGs considered as alternative for medium-energy acceleration in neutrino factory
- Harmonic number jump: high frequency RF
  - Only allows one direction
- FODO lattice: opposite charges, same direction
  - Requires sufficient beam separation for passive extraction
- Use transverse mode cavities to vary energy gain

Scaling FFAGs
Bidirectional FODO



Harmonic Number Jump Varying Energy Gain